PATHOLOGY RESEARCH

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Pathology research addresses the important diseases affecting sugarcane in Louisiana. The overall program goal is to minimize losses to diseases in the most cost-effective manner possible. Projects receiving major emphasis during 2003 were billet planting, ratoon stunting disease (RSD) management; assessing the threat posed by our newest disease, sugarcane yellow leaf; improving our understanding of root disease; and breeding and selection of disease-resistant varieties. Research on billet planting and results concerning the spread and increase of yellow leaf are reported separately.

RATOON STUNTING DISEASE

RSD testing was conducted by the Sugarcane Disease Detection Lab for the seventh year during 2003. RSD was monitored in fields on commercial farms, in the American Sugar Cane League Variety Release Program, in the Local Quarantine (to provide healthy source material for commercial seedcane production), and at all levels of Kleentek® seedcane production (Table 1). In 1997, the first year of on-farm testing, the number of farms with RSD detected in at least one field, the frequency of fields with RSD-infected cane (across the entire industry), and the frequency of stalks within a field with RSD averaged 83, 51, and 12%, respectively. In 2003, these statistics had decreased to 32, 9, and 1%, respectively. These numbers had been declining progressively each season; the statistics were 10% and 5% for farms and fields, respectively, with RSD in 2002. However, more testing was conducted during 2003, and effort was made to test more fields per farm and different varieties. RSD no longer exhibits a typical pattern for a disease spread mechanically during planting and harvest, in which infection levels increase progressively with more harvests, and higher levels of disease are detected in ratoon or stubble crops (Table 2). The incidence of RSD was lowest in recent progeny of tissue culture produced seedcane (Table 3). However, many of the fields listed as "field run" were LCP 85-384 from Kleentek® seedcane that had been increased more than three times. There is very little heat-treated progeny in the industry any more. Factors associated with reductions in RSD are planting of certified healthy seedcane and widespread planting of LCP 85-384, a variety with some resistance to RSD spread. The testing results are encouraging. However, the sample size (20 stalks per field) used for RSD testing on farms is too small to reliably detect low levels of RSD infection. The results suggest that RSD is persisting on many farms in the industry at a low level. This could lead to a resurgence of RSD, if a susceptible variety becomes widely planted in the future. If farmers continue to use a healthy seedcane program, they have the opportunity to eliminate RSD from their farms.

Results were collected from second stubble of an RSD spread experiment comparing rates of disease spread in different varieties caused by harvest with a whole stalk or chopper harvester. The highest rates of RSD spread occurred in LCP 82-89 and HoCP 91-555. Rates of RSD spread caused by the whole stalk and chopper harvesters were similar.

SUGARCANE YELLOW LEAF

Sugarcane yellow leaf virus (SCYLV) causes yellow leaf, our most recent disease in Louisiana. Research is under way to determine the potential impact under Louisiana conditions. Results have been obtained from two experiments to determine the effect of SCYLV on yield of LCP 85-384 (conducted in cooperation with Dr. Mike Grisham at the USDA-ARS Sugarcane Research Unit Ardoyne experimental farm). No significant yield loss was detected in plant cane or two stubble crops in one experiment and plant cane in a second experiment. A tissue-blot immunoassay using imprints from leaf mid-ribs was used in the Sugarcane Disease Detection Lab for the detection of SCYLV (Table 4). Sources of Kleentek® seedcane were monitored for SCYLV for the fourth year, and very little virus was detected. The results from the yield loss experiment with LCP 85-384 suggest that yellow leaf may not significantly reduce yield. Nonetheless, if a problem was detected in a Kleentek® seedcane field, cane was not sold from that field. LCP 85-384 will become infected with the virus, and varieties grown in the future may be adversely affected by yellow leaf. Therefore, the decision was made to include yellow leaf in the seedcane certification standards. Louisiana Department of Agriculture and Forestry inspectors will collect leaves from seedcane fields during the June inspection, and the LSU AgCenter Sugarcane Disease Detection Lab will test the samples for SCYLV. It is hoped that providing the industry with near-virus-free seedcane will prevent a buildup of virus infection levels in commercial fields and help to manage this disease in the future.

A graduate student project conducted by Chris McAllister under the supervision of Dr. T. E. Reagan and Dr. J. W. Hoy is investigating the entomological and pathological factors affecting the spread and increase of sugarcane yellow leaf. A followup to a statewide survey was conducted during 2003 to evaluate disease increase, and rates of increase and patterns of disease spread were determined in two plant cane and two ratoon fields of LCP 85-384. The results of this research are reported separately.

ROOT DISEASE

A basic research project is in progress addressing the effects of root pathogens and disease on sugarcane growth and productivity. Pythium root rot and nematodes are known to be constraints to sugarcane growth and yield. However, evidence suggests that long-term cultivation of sugarcane can result in the development of a total soil microorganism community that is detrimental to sugarcane growth. Indirect evidence for this can be seen in the high yields obtained when cane is planted in “new ground” with no recent history of sugarcane cultivation. Three sites with paired fields, one with a long-term sugarcane cultivation history and one with no recent cultivation history, were compared for culturable microorganisms present in the rhizoshere soil (soil in close proximity to roots exposed to root exudates). Differences in the pattern of utilization of multiple substrates (potential food sources) were detected between soils from fields with and without a recent sugarcane cropping history. However, fields with a long-term sugarcane cropping history from different sites showed differences in substrate utilization profiles. Differences also were detected between soil microbial communities from fields with and without a sugarcane cropping history in the quantity and type of culturable microorganisms. These differences provide information about the possible changes in microbial community make-up that can result from sugarcane monoculture. We are attempting to identify the organisms that account for the differences in community make-up in soil from “new” and “old” ground fields. The hope is that improved understanding of the effects of the total soil microbial community on sugarcane root development will allow us to determine ways to manipulate or manage the community to promote root system health and improve plant growth.

SELECTION OF DISEASE-RESISTANT VARIETIES

Experimental varieties in the selection program are screened and rated for resistance to mosaic, smut, and leaf scald. Natural mosaic infection levels were determined in breeding program outfield yield trials. Little infection was detected in experimental varieties during 2003. Smut resistance in experimental varieties was evaluated in an inoculated test in which stalks were dipped in a smut spore suspension then planted during August 2001. Smut infection levels were determined during July 2003 and compared to infection levels in varieties with known resistance reactions. Within the experimental varieties, 17 (50%), 16 (47%), and 1 (11%) of 34 were rated as resistant, moderately susceptible, and highly susceptible to smut, respectively (Table 5). Leaf scald also was evaluated in experimental varieties using an inoculated test. During June, shoots were cut above the growing point and sprayed with leaf scald bacteria. Symptoms were evaluated later in the growing season, and clones were rated for their resistance level (Table 6). Ten (29%), 22 (65%), and 2 (6%) of 34 experimental varieties were rated as resistant, moderately susceptible, and highly susceptible to leaf scald.

Table 1. RSD testing summary for 2003.

Source	Location	No. of fields	No. of varieties	No. of samples
Louisiana growers	Statewide	443	10	8830
Variety Release Program	1° & 2° stations	-	17	1244
Goosecreek®	Foundation stock	-	1	8
Helena®	Foundation stock	-	4	25
Kleentek®	Foundation stock	-	6	26
Kleentek®	1° increase farms	13	3	250
Kleentek®	2° increase farms	30	3	600
Local Quarantine	LSUAC	-	14	89
Research	LSUAC	-	-	1379
Totals		486		12,451

Table 2. RSD field and stalk infection frequencies in different crop cycle years for all varieties combined during 2003.

Crop Year	Total number of fields	Average field infection (%)	Total number of stalks	Average stalk infection (%)
Plant cane	97	9.3	1934	2.1
First stubble	73	5.5	1453	0.5
Second stubble	118	10.2	2352	1.5
Older stubble	148	9.5	2951	1.1
Totals	436	8.9	8690	1.3

Table 3. RSD field and stalk infection frequencies as affected by healthy seedcane programs for all varieties combined during 2003.

Seedcane program	Total number of fields	Average field infection (%)	Total number of stalks	Average stalk infection (%)
Heat-treated	4	25	80	2.5
Kleentek®	260	8	5179	1.1
Goosecreek®	34	12	677	0.7
Field-run	123	11	2454	2.1

Table 4. Sugarcane yellow leaf virus testing summary for 2003.

Source	Location	No. of fields	No. of varieties	No. of samples
Louisiana growers	State-wide	2	1	102
LSUAC	St. Gabriel & Iberia	-	41	541
Kleentek®	Foundation stock	-	9	39
Kleentek®	1° increase farms	30	7	597
Kleentek®	2° increase farms	45	3	983
Local Quarantine	LSUAC	-	14	89
Research	LSUAC	-	-	8189
Totals		77		11,593

Table 5. Smut infection level and resistance ratings for experimental varieties determined from an inoculated test during 2003.

Variety	Infection (%)	Rating[x]	Variety	Infection (%)	Rating[x]
CP 65-357	50	9	HoCP 00-933	0	1
CP 73-351	50	9	HoCP 00-934	0	1
CP 74-383	27	6	HoCP 00-939	0	1
CP 81-335	15	4	HoCP 00-942	1	2
Ho 95-988	15	4	HoCP 00-945	9	4
HoCP 96-540	5	3	HoCP 00-950	0	1
L 97-128	17	5	HoCP 00-951	0	1
L 98-209	9	4	HoCP 00-960	0	1
L 99-226	31	6	L 01-280	0	1
L 99-233	25	6	L 01-281	0	1
HoCP 99-825	8	4	L 01-283	1	2
HoCP 99-866	7	3	L 01-290	3	2
L 00-247	14	4	L 01-292	0	1
L 00-259	10	4	L 01-296	19	5
L 00-266	24	6	L 01-299	68	9
L 00-268	16	5	L 01-300	2	2
L 00-270	29	6	L 01-306	14	4
HoCP 00-905	7	3	L 01-312	0	1
HoCP 00-927	11	4	L 01-314	16	4
HoCP 00-930	23	5	L 01-315	0	1

[x]Resistance ratings assigned on a 1-9 scale in which 1-3 = resistant, 4-6 = moderately susceptible, and 7-9 = highly susceptible.

Table 6. Leaf scald resistance ratings for experimental varieties determined from an inoculated test during 2003.

Variety	Rating[x]	Variety	Rating[x]	Variety	Rating[x]
CP 65-357	6	L 00-266	5	L 01-280	6
CP 73-351	5	L 00-268	3	L 01-281	7
CP 74-383	8	L 00-270	2	L 01-283	4
CP 81-335	4	HoCP 00-905	2	L 01-290	3
Ho 95-988	5	HoCP 00-927	5	L 01-292	5
HoCP 96-540	4	HoCP 00-930	3	L 01-296	6
L 97-128	4	HoCP 00-933	3	L 01-299	5
L 98-209	4	HoCP 00-934	4	L 01-300	5
L 99-226	5	HoCP 00-939	5	L 01-306	4
L 99-233	5	HoCP 00-942	6	L 01-312	2
HoCP 99-825	5	HoCP 00-945	3	L 01-314	3
HoCP 99-866	5	HoCP 00-950	7	L 01-315	5
L 00-247	5	HoCP 00-951	6		
L 00-259	2	HoCP 00-960	4		

[x]Resistance ratings assigned on a 1-9 scale in which 1-3 = resistant, 4-6 = moderately susceptible, and 7-9 = highly susceptible.